Executive Summary

The goal of this thesis was to examine the viability of Statistical Arbitrage in Government Bond Futures. This was achieved by applying well known methods of Pairs Trading to data from the World Bond Futures page on Bloomberg. Data includes historical data on Futures for diverse currencies and maturities for the period of 2002 to 2022.

The examined strategies rely on identifying relative mispricings between a pair of securities instead of determining their fundamental values. Whenever a pair is identified, the dependence structure between the assets can be quantified using statistical methods to generate trading signals. There exist many ways of identifying pairs, and this thesis applies the Sum of Squared Deviations between normalized price time series to match assets into pairs. Whichever pair has moved together the closest in the past will exhibit the smallest Sum of Squared Deviations and will therefore be matched in a pair.

Three different strategies were tested to generate returns based off the identified pairs. The first strategy is based on the distance approach, which uses estimates for the standard deviation of normalized price spreads between a pair to generate trading signals. Whenever the spread exceeds two historical standard deviations, a long-short position is initiated based on the direction in which the spread has diverged. Positions are unwound whenever normalized prices converge again. The second and third strategies are based on the Copula approach to Pairs Trading, which relies on modeling the dependence structure of a pair's returns by using Copulas. Copulas combine the best fitting marginal distributions of returns into a multidimensional joint distribution function. They can then be used to compute conditional probabilities, also called the Mispricing Indices, which are then used to interpret the co-movement of assets. This allows the arbitrageur to make statements about whether an

asset within the pair has overperformed, underperformed, or moved fairly, relative to its partner on any given day. Two different rules of generating trading signals based on the values of the Mispricing Indices are tested. The first rule is called the Simple Threshold Rule, which generates trading signals based on large divergences that happen on a single day. Whenever the conditional probability of an asset exceeds a Mispricing Index of 0.95 or is smaller than 0.05, a long-short position is initiated based on the direction of divergence and thereafter unwound whenever the prices behave as if they reached equilibrium again. The second rule is called the Cumulative Flag Rule, which cumulatively adds up the daily divergences of the Mispricing Indices from a fair value of 0.5 until the sum reaches an arbitrary threshold. The cumulative sums are called Flags in this approach. Whichever asset has overperformed during this period is shorted, whereas the underperforming asset is bought. Positions are unwound when the Flags reach 0 again. To prevent a pair from continually diverging, a stop-loss parameter can be implemented by setting a maximum value for the Flags.

The strategies were tested in the following way. During a formation period, the top three pairs out of all possible pairs with the smallest Sum of Squared Deviations are identified as pairs and thereafter traded for a predefined amount of time during the trading period. Each month, a new portfolio is opened and ran for a predefined amount of time. Therefore, the methodology concurrently runs different portfolios in an overlapping way. Previous research has relied on a one year formation period and a six months trading period. Three different period length configurations were employed in this thesis, namely one year and six months, six months and three months, and two years and one year for the formation and trading periods.

The Results identify the Copula approach using the Cumulative Flag Rule as the best strategy out of the three. In its standard form, the strategy would have yielded an average annualized return of 1.90% over the past 20 years, with a Sharpe ratio of 1.15 and 87.66% of

portfolios yielding positive returns. The shorter period length configuration exhibits better performance, with an annualized return of 1.95%, a Sharpe Ratio of 1.23 and 84.43% of portfolios yielding positive returns. In addition, removing the universal stop-loss parameter improves the strategy's performance, and it can be further optimized by tuning thresholds.

The second best performance is achieved by the distance approach. In its standard form, the strategy would have yielded an average annualized return of 0.65%, with a Sharpe ratio of 0.48 and 65.53% of portfolios yielding positive returns.

The third strategy, the Copula approach using the Simple Threshold Rule, can be disqualified as a viable strategy. It is excessively sensitive, leading to an unreasonable amount of necessary roundtrip trades, and fails to break even in most cases. The only period length configuration which generates positive returns is the 6m/3m configuration, with an average annualized return of 0.07%. Even after optimization, results remain unpromising.

This thesis also contains rough recommendations on how to set the threshold values of the Flags when applying the strategies to Government Bond Futures. Threshold values in the literature are recommended based on stock market data, and only for the 1y/6m period lengths. Interestingly, the standard recommendations for thresholds are very close to optimal even for Government Bond Futures, but only for the 1y/6m period length configuration. In other configurations, the optimal ranges of the thresholds can differ widely. For the Cumulative Flag Rule, setting the threshold value of flags d to 0.69 and 0.95 for the shorter and longer period length configurations, respectively, would have notably improved performance.

To conclude, the results identify the Cumulative Flag Rule as a promising strategy. The Copulas are effective in estimating the dependence structure between Futures and are able to reliably generate returns from it. Performance could be improved upon by experimenting with different conditions and rules of generating trading signals in the future.